

Appendix C7

CRUCIBLE/TRENT TUBE

**2100 East Orangethorpe Avenue,
Fullerton, CA**

CRUCIBLE/TRENT TUBE

2100 EAST ORANGETHORPE AVENUE, FULLERTON, CA

1.0 SUMMARY OF OPINION

With respect to the site located at 2100 E. Orangethorpe, Fullerton, California, my opinion is as follows:

1. Was there a release of any of the contaminants of concern at the site that impacted the groundwater?

Yes, the available information on site operations, and concentrations of TCE, PCE, 1,1,1-TCA, and 1,1-DCE in soil and soil vapor samples indicate that these compounds were used and released at the site. Groundwater samples collected by OCWD in 2011 show that the upper zone of the shallow aquifer is contaminated with PCE, 1,1-DCE, TCE, 1,1,1-TCA, and 1,4-dioxane. The presence of these COCs is consistent with the usage of solvents at the site, and with soil and soil gas data collected at the site. [There is believed to be another source of 1,4-dioxane that is also impacting the upper zone near the 2100 E. Orangethorpe site.] OCWD also collected groundwater samples from the middle zone of the shallow aquifer. These samples show that COCs released from this site have also impacted the middle zone.

There were two primary areas where Crucible released COCs that have impacted the groundwater. One area is near a degreaser that was inside the building that was used to remove grease used in resizing the tubing. The other area was on the south side of the building, between the building and Carbon Creek. Releases of COCs occurred in storage areas adjacent to the building, and in an unpaved area next to the creek.

2. How did the release occur?

The release of TCE, PCE, 1,1,1-TCA, and 1,4-dioxane occurred through use of TCE, PCE, and 1,1,1-TCA by Crucible (and related companies) to degrease tubing, and the storage and handling of the virgin and waste solvents. Crucible would pull tubing through resizing dies to produce tubing of various diameters for hydraulic lines for aircraft. Lubricants were used to reduce friction as the tubing was pulled through the dies. After the resizing was completed, the grease was removed by dipping the tubes in chlorinated solvents in a dip tank that was approximately 54 feet long. The tank was recessed into the floor in an unlined concrete pit. Virgin and waste solvents were stored on the south side of the building. Spills or other releases occurred in and near this storage area.

1,1,1-TCA is unstable in water, and degrades to acetic acid and 1,1-DCE. Therefore, releases of 1,1,1-TCA will contaminate the water with not only 1,1,1-TCA, but also 1,1-DCE (a degradation product) and 1,4-dioxane (a stabilizer).

3. Are there contaminants of concern from upgradient sources that may be impacting groundwater beneath the site?

Yes. A well-documented plume of PCE (from AC Products) extends beneath the Crucible site, and the contaminants from Crucible's release of TCE, PCE, and 1,1,1-TCA have commingled with this plume. Because of an active groundwater remediation effort by AC Products, PCE concentrations upgradient of the Crucible site have decreased significantly, and concentrations of PCE that was released by AC Products may be near the detection limit a short distance upgradient of the Crucible site at the present time.

4. Have contaminants of concern that were released from the site commingled with contaminants from other sites?

Yes. As discussed above, the AC Products PCE plume extended beneath the Crucible site, and contaminants from the site commingled with the AC Products plume. In addition, contaminants (TCE, PCE, and 1,1-DCE) released from the Crucible site can probably be tracked to the Laura Scudder's site and probably extend beneath the EMD site. Is so, they have commingled with contaminants from EMD and the Monitor Plating site immediately upgradient of EMD.

5. Are the contaminants of concern released from the site likely to be captured by the Orange County Water District extraction wells being installed as part of North Basin Groundwater Protection Project?

Yes. The COCs will be captured by EW-4, based on the result of modeling simulations.

Information is still being collected and produced for numerous sites within the project area, and I reserve the right to modify and update my opinion.

The basis for my opinion is provided in the following sections.

2.0 SITE HISTORY

Two adjoining parcels of real estate on Orangethorpe Ave. were purchased on March 18, 1957 and July 8, 1959 by Trent Tube. Shortly thereafter, the Fullerton facility was constructed and completed before March 25, 1959 based on aerial photography review. Over the years the name of the company owning the property changed several times, between Crucible, Trent Tube, Colt, and variations of each name (CRU 00088). [The name Crucible will be used to refer to these entities in the following discussion.] On May 11, 1984 all manufacturing operations at the plant ceased. In November 1985 Colt Industries Operating Corp. sold the property to Howard K. Marlow. Another source states the property was sold to LaBarron Investments in 1985 (CRU 00085). Therefore, Marlow was associated with LaBarron Investments or sold the property within a month to LaBarron Investments.

Since 1987, the tenants have been Auto Car Leasing and Executive RV Center (based on address directories). Auto Car Leasing or the Executive RV Center are not known to use chlorinated solvents and have not been listed in the Toxic Release Inventory (TRI) database or as hazardous waste generators.

The DTSC sent LaBarron Investments an Enforcement Order for Corrective Action on June 10, 2002 (OCVOCEF 000421). After conducting additional soil gas investigations, LaBarron

Investments received a letter from DTSC approving the Remedial Facility Investigation report, which had concluded that no additional investigations were necessary (OCVOCEF 000062 – OCVOCEF 000063). However, neither Crucible and successor companies nor LaBarron Investments has investigated whether the groundwater beneath and downgradient of the site became contaminated with VOCs that were released at the site.

2.1 Operator 1 – Crucible (1959-1984)

2.1.1 Site Operations

The Crucible facility resized stainless steel or other metal/alloy tubing to customer specifications. Prefabricated tubing was coated with oil to lubricate the tubing during the cold draw process to create smaller diameter tubing. This cold drawn tubing was next immersed in a solvent degreaser to remove the oil from the tubing (CRU 00197-CRU 00199). The tubing was then raised up out of the dip tank and the solvent was allowed to condense on the tubing as a vapor then drip back down into the dip tank. This process was typically repeated three to four times per bundle of tubing (Deposition of Harry Murphy, 2007, p.70). The tubing was then placed in a pickle liquor tank for cleaning and descaling of the tubing. The facility had two pickle liquor tanks with capacities of 2,000 gallons each (CRU 00197-CRU 00199).

The degreasing pit, located in the center of the building (Facilities Features figures, *Facility Features* divider), was comprised of a steel dip tank and a still. The approximate degreasing pit dimensions were 54 ft (L) x 7 or 8 ft (D) x 13 ft (W). The degreasing pit was made of poured concrete without any lining that would inhibit the movement of organic solvents into and subsequently through the porous concrete, and extended beneath the floor to a depth of approximately 7 or 8 feet. The dip tank was made of welded stainless steel on the inside and painted carbon steel on the outside. The approximate dip tank dimensions were 54 ft (L) x 12 ft (D) x 3 ft (W). It extended above the floor approximately 4 or 5 feet. Solvent was filled to a level of 2 ft deep in the dip tank. This solvent volume corresponds to approximately 2,400 gallons. The still dimensions are unknown, but it was located in the southeast corner inside the degreasing pit. (Deposition of Harry Murphy, 2007, pgs. 66, 116, 156).

There were four concrete impounds located outside and adjacent to the building on the south side based on the Operations Plan for Hazardous Waste from 1983 (NGSC-DTSC005435). At that time, these concrete impounds were used to store tanks and drums of liquid wastes, virgin 1,1,1-TCA, and kerosene. Going from west to east, the first impound near the southwest corner of the building was used to store waste (CRU 00503 Figure 2 [labeled as Figure 6 on that page]). The type of waste is unknown. The next impound contained 55 gallon drums of waste 1,1,1-TCA, waste kerosene, and waste mineral spirits (CRU 00503 Figure 2 [labeled as Figure 5 on that page]). The third impound contained waste oil, waste detergent, virgin 1,1,1-TCA and kerosene in above-ground storage tanks [ASTs] (CRU 00138; CRU 00209), and the 200-gallon waste oil tank (CRU 00504 Figure 3 [labeled as Figure 4 on that page]). The fourth impound contained concentrated acids (CRU 00504 Figure 3 [labeled as Figure 3 on that page]).

Also located on the property were one liquid ammonia and two hydrogen tanks, a propane tank, a maintenance building, a box construction area, record storage, compressed nitrogen gas

cylinders, lubricant storage, and raw tubing storage (CRU 00502). The ammonia was used to neutralize the spent pickle liquor and the oil was used in the cold drawing process (CRU 00197-CRU 00198). Liquid hydrogen was used to generate an inert hydrogen atmosphere around the tubing during heat treatment to prevent oxidation. Propane was used to heat water in a water tank in the office area as a means to heat the solvents in the degreaser. The maintenance building was used for welding, grinding, and machine repair. The box construction area was used to assemble wooden boxes for shipping the final product. Nitrogen gas was used during inspections to blow out the tubing (Deposition of Harry Murphy, 2007, p.52-63).

There is no additional information in available records regarding lubricant storage, and raw tubing storage. However, an employee deposition indicates that raw tubing was stored outside the building on the east side (Deposition of Christopher Sollitto, 2008, p. 64). This corresponds with a 1978 aerial photo which shows what appear to be piles of tubing along the east side of the property.

2.1.2 Solvent/Chemical Use

The site switched solvents used from TCE to PCE, back to TCE, and then to 1,1,1-TCA. The following information was used to estimate the timeframe of each switch.

- Early TCE usage:
 - 1966 (February 16): A site inspection by the Fullerton Fire Department (FFD) lists 30 55-gallon drums of Triclane D (metal degreasing grade “trichloroethylene” [trichloroethylene, TCE]) (CRU 00585).
 - 1967 (March 23): During another FFD site inspection, 500 gallons of “trichloroethylene” (noted as “TOXIC”) were noted on the south wall and 3,200 gallons of “Tri-Chloro-Ethelene”, kept at 190°F were located in the center of the plant (CRU 00583). The latter refers to the degreaser containing more than 2 ft of solvent based on the dimensions provided by Mr. Murphy.
 - 1967 (November 10): South Coast Air Quality Management District (SCAQMD) issued a permit to operate a solvent degreaser (>1 lb VOC/day). The type of solvent is not listed but could have been either TCE or PCE (CRU 00588).
- PCE usage:
 - 1968 (November 28): A permit was issued by the FFD for the facility to store, handle, transport, or use 4,200 gallons of “perchlorethylene” or PCE (CRU 00587).
 - 1976 (April/May): An inspection was conducted by the FFD on April 13, and a note added on May 5 states that perchlorethylene was no longer used. (CRU 00577). This confirms that PCE had been used in the past, but that the facility had switched back to TCE by 1976.
- TCE usage:
 - 1976 (April 13): A FFD inspection listed a 4,000 gallon trichloroethylene tank adjacent to the south wall outside the building. This tank had fixed plumbing that connected with the inside dip tank. The inspector’s recommendation to secure the tank from movement indicates that it was an AST.
 - 1976 (May 5): A permit to store, handle, or use a 4,000 gallon tank of “trichloroethylene” was issued by the FFD (CRU 00572).

- 1977 (November 29): During an inspection, the Fire Department inspector had a discussion with the Plant Engineer about a proposed 600 gallon waste oil/TCE AST south of the plant near the property boundary. Also, an existing 1,200 gallon TCE tank adjacent to the south wall of the building was planned to be remodeled to contain 600 gallons of TCE (CRU 00577). It's not clear whether the 1200-gallon tank existed at the same time as the 4000-gallon tank, or whether it replaced the larger tank.
- 1,1,1-TCA usage:
 - 1980: A memo dated December 18 shows that 1,1,1-TCA degreaser sludge was purchased by Acto-Clean for 1,1,1-TCA reclamation on November 12, 1980 (SOLLITTO00009). Hence, by 1980 the facility was using 1,1,1-TCA.
 - 1983: An August 26, 1983 plan dealing with hazardous waste operations, treatment, and storage indicates that 1,1,1-TCA was used for degreasing (NGSC-DTSC005435; CRU 00138).
 - 1984: The facility was closed in 1984, and the text of the April 1, 1984 Closure Plan clearly indicates that 1,1,1-TCA was used as the chlorinated solvent at the time of closure (CRU 00461).

To summarize, all of the COCs were used at the site. From the beginning of operations in approximately 1958 the solvent used was undocumented, but was probably TCE. TCE was documented to be used from 1966 to 1968. PCE was used from 1968 to about 1976. TCE was used again from 1976 to about 1980. Finally, 1,1,1-TCA was used from 1980 until closure on May 11, 1984.

Other chemicals used at the site include ammonia, hydrogen, nitric and hydrofluoric acids, kerosene, mineral spirits, propane, and oil for cold drawing (CRU 00197-CRU 00199). Amounts used are unknown, but waste generated from these chemicals is discussed below.

2.1.3 Waste Disposal

The earliest information on disposal of waste dates back to only 1980. Information on earlier practices is not available. On September 5, 1980, Whittier Drum & Vac transported 4 drums of grease (degreaser sludge) and 1,700 gallons of degreaser sludge to the B.K.K. landfill. The type of solvent in the sludge is not provided. On November 12, 1980 Acto-Clean purchased 8 drums (~440 gallons) of degreaser sludge for reclamation of 1, 1, 1-trichloroethane (1,1,1-TCA) (SOLLITTO00009). In the 1983 Operations Plan, the annual volume of waste 1,1,1-TCA generated by the site was listed as "800/1300 gallons." The waste consisted of 40-60% 1,1,1-TCA and the balance was tramp oils (CRU 00199). The 1985 Closure Plan for the site stated the maximum storage capacity of waste 1,1,1-TCA at that time was 15 55-gallon drums or 825 gallons (CRU 00435-CRU 00579). The solvent degreaser had a maximum capacity of approximately 2,400 gallons (CRU 00138).

Waste 1,1,1-TCA from the still bottom in the degreasing pit was pumped into 55 gallon drums for storage (Deposition of Harry Murphy, 2007, p.123). These drums were stored in cement block and concrete impounds adjacent to the southern wall of the building (See the Facility Features figure). The waste 1,1,1-TCA was reclaimed every 2 to 3 months by an outside vendor (CRU 00200).

Before disposal, spent pickle liquor was neutralized with ammonia that is piped over from the ammonia tank located east of the building. Disposal of spent pickle liquor occurred every 3 to 5 months. Annual volume was between 7,000 and 10,000 gallons (CRU 00197).

Waste oil was removed from the AST in the concrete impound via a vacuum truck every 1 to 3 months (CRU 00198).

2.2 Operator 2 – Auto Car Leasing and Executive RV Center (after May 1984 -present)

2.2.1 Site Operations

Auto Car Leasing sells and leases automobiles. Executive RV Center stores/sells motor homes and boats (OCVOCEF 000028).

2.2.2 Solvent/Chemical Use

Executive RV Center generates approximately 150-200 gallons of waste oil per year (CRU 00568; OCVOCEF 000036). There is no indicated use of any of the COCs.

2.2.3 Waste Disposal

Waste disposal practices are unknown. The site was not listed on the TRI database.

3.0 HYDROGEOLOGY

Twenty borings were installed by Frey Environmental in October 2002 as part of the RCRA Facility Investigation (RFI) to delineate the lateral and vertical extent of soil contamination (OCVOCEF 000601). The deepest boring (B-1) went only 20 feet below ground surface (bgs). Soil lithology encountered at the site consisted of mainly fine to medium grained sands and silty sands (OCVOCEF 000608). One silty clay layer was observed in B-16 from 1 to 4 ft bgs. An additional investigation was conducted by Frey in 2003 where some borings were extended to 40 ft bgs near the former degreaser for purposes of soil vapor sampling (OCVOCEF 000264). However, lithologic logs were not included in the report. Therefore, limited information on site lithology exists past 20 ft bgs.

There are no site-specific groundwater data at this site. Based on July 2008 data from the nearby monitoring wells, MW-25S, MW-26S, and MW-23, the direction of groundwater flow is to the west. Depth to water ranges from 106 to 127 feet as a result of operating of recharge basins along the Santa Ana River to the east of the site.

OCWD installed four borings near this site. The upper 60 to 70 feet were primarily sand and gravel, with the silt content increasing at the greater depths. Clay was noted in three of the four borings, at approximately 80 to 85 feet. The materials above this clay (upper zone of the shallow aquifer) were saturated so that water samples could be collected. The middle zone of the shallow aquifer was also saturated. The borings were not constructed as monitoring wells, so it was not possible to collect representative water-level data.

4.0 EVIDENCE OF RELEASES

Evaluation of soil and soil gas data should take into consideration other possible sources of the COCs that are nearby. Surrounding sites include Vista Paint, a manufacturer of paint and architectural coatings, to the west. Vista Paint had a leaking UST in 1999 that contained ethylene glycol (NGSC-VIS000012-NGSC-VIS000013). Vista Paint is also listed in the TRI database and had air emissions of 1,1,1-TCA in 1989-1991 of 250 lbs/yr (TRI). Across Orangethorpe to the north is the Kimberly-Clark plant, a manufacturer of paper products who used 1,1,1-TCA for degreasing and cleaning purposes. Kimberly-Clark is also listed on GeoTracker as having a leaking UST in 1986 that contained diesel fuel. East of the site is a self-storage facility (Guardian Self Storage) with no environmental database listings.

4.1 Reported Releases

In the documents available for review, there were no reports of spills to regulatory agencies or in internal memos or reports. However, Mr. Murphy described solvent vapors escaping from the still after being left on one night in the late 1970s or early 1980s that reached the furnace and caused a fire. The automatic sprinkler system turned on and the fire department came to the site. He was not aware what happened to the water runoff from the sprinklers (Deposition of Harry Murphy, 2007, p.115-118).

4.2 Contaminant Distribution

The spatial distribution of averaged COC concentrations in soil, soil vapor, and groundwater can be seen in the maps presented under the pertinent dividers. Bubble plots are used to portray the concentrations of individual compounds; the area of the bubble is representative of the concentration being portrayed. Pie charts are used to indicate both the relative concentrations between different contaminants, and the sum of their concentrations. For the bubble plots, the same scaling factor is used for all compounds and depth ranges for a particular medium (soil, soil gas, or groundwater) so that differences between compounds or depths are readily apparent. The same approach is used for the pie charts, but the scaling factors are different from those used in the bubble charts because of different approaches used in the GIS software.

The soil figures portray the average of the concentrations measured within the indicated depth ranges in a boring for TCE, PCE, 1,1,1-TCA, and 1,1-DCE. For soil gas, the figures are similar, but the measurements were not separated into depth ranges before averaging. The figures for groundwater show temporal averages rather than spatial averages. A monitoring location was designated as being in the upper zone of the shallow aquifer if the bottom of the screen was shallower than 100 feet, and in the middle zone if below 100 feet.

Because analyses typically did not include 1,4-dioxane, this compound is not included in the pie charts. However, figures are presented to provide information on 1,4-dioxane data for groundwater.

The measured concentrations on which the figures are based are provided in the Overview Report in Appendices A1, A2, and A3 for soils, soil gas, and groundwater data, respectively. The vertically averaged values used to construct the soils and soil gas figures are provided in

Appendices B1 and B2 of the Overview Report, respectively. The temporally averaged groundwater data are presented in Appendix B3 of that report.

4.2.1 Evidence of Soil Contamination

There were two rounds of soil sampling. Figure 4.2-1 is a cross section showing the distribution of the COCs with depth. In the first (December 1984), Crucible performed an evaluation of contamination of soils on the south side of the building. However, they did not perform an adequate characterization, with only 1 sample collected at a depth greater than 11 feet. Seventeen soil borings were advanced to depths up to either 6 or 10.5 ft bgs as part of the Site Remediation Plan for the contaminated soils along the southern boundary (NGSC-DTSC004954). The detection limit for these samples was 500 µg/kg. Boring D-2, located near the southern property line, had an 1,1,1,-TCA concentration of 780,000 µg/kg, PCE concentration of 21,000 µg/kg, TCE concentration of 70,000 µg/kg, and xylene concentration of 95,000 µg/kg at a depth of 3.5 ft bgs. These high concentrations of solvents which were used for degreasing at different time periods indicate that releases occurred in this area many times. Borings C-3 (located halfway between the building and property line) and A-1 (adjacent to southwest impound area) had lower detections of 1,1,1,-TCA (2,200 and 1,200 µg/kg, respectively) and PCE (1,100 and 5,300 µg/kg, respectively) at a depth of 3.5 ft bgs. The 1,1,1-TCA concentration reported in boring D-2 (780,800 µg/kg) was the highest measured in the project area. Because of the high detection limit (500 µg/kg), deeper contamination (which was likely present because of the high concentrations of the three solvents used for degreasing measured in the shallowest samples) was not reported. [Analytical results (<500 µg/kg for 1,1,1-TCA, PCE, and TCE) were provided for boring A-4 but its location was not indicated on maps presented in the January 18, 1985 remediation plan (NGSC-DTSC004954-NGSC-DTSC004980) or other documents.] A total of 20 truckloads of soil (281 cu. yd.) were excavated from the area surrounding boring D-2 and from the strip of land south of the property line toward the flood control channel and sent to a Class I landfill in February 1985 (CRU 00443-CRU 00444). No records of confirmatory soil sampling are available.

The second round of sampling was performed eight years later. An RFI was conducted in October 2002 in which 20 soil borings were installed to depths of 20 ft bgs or less (OCVOCEF 000593-OCVOCEF 000695). However, only 7 of the 20 borings were sampled for VOCs and all seven samples were ND (detection limit was 5 µg/kg). Four of these borings were located near the former dip tank (B1-B4) and the other three borings (B18-B20) were background samples located either to the north of the main building or in the southeastern corner of the property. Boring B1 (not to be confused with B-1) was installed at the north end of the dip tank to a depth of 20 feet. At three other sampling locations (also near the dip tank), the deepest samples were collected at 10 feet bgs. Two samples near the waste oil tank were only 2 feet deep. Three background samples were collected at a depth of 3 feet. LaBarron Investments did not analyze any samples for VOCs in the area where soils were excavated in 1985.

In 2011, OCWD collected soil samples from two borings that were near, but not at, the dip tank and the waste storage areas. CM-GW02 was drilled approximately 90 feet west of the dip tank. Soil samples were collected every 10 feet. No detectable concentrations of COCs occurred until depths of 60 and 70 feet. The sample at 60 feet contained PCE (9.2 µg/kg), 1,1,1-TCA (2 µg/kg), and cis 1,2-DCE (1.8 µg/kg). The deeper sample (70 feet) contained PCE (33 µg/kg),

TCE (6.9 µg/kg), and 1,1-DCE (19 µg/kg). The proportions in the 70-foot sample are similar to those that were found in a water sample collected at 76 feet. CM-GW03 was drilled about 75 feet west of where the high concentrations of 1,1,1-TCA, TCE, and PCE were measured on the south side of the building. These samples had measureable concentrations of PCE in nearly every sample, but non-detectable concentrations of the other COCs, with two exceptions. The sample collected at a depth of 30 feet contained PCE (22 µg/kg), TCE (2.6 µg/kg), and 1,1,1-TCA (4.5 µg/kg). The sample collected at 80 feet contained PCE (7.6 µg/kg) and 1,1-DCE (1.9 µg/kg). The deep samples were probably affected by the contaminants found in the water at these depths.

Very limited soil sampling has been performed at this site, and the extent of soil contamination is not well-known. The detection limit used in the sampling around the dip tank was 500 µg/kg, and thus these samples provide little useful data. The shallow soils on the south side of the building were very contaminated. However, high detection limits and the limited depth of samples collected in this area resulted in very limited information on the extent of soil contamination. The highest measured concentration of 1,1,1-TCA, and second highest concentration of TCE, in the project area were measured here.

4.2.2 Evidence of Soil Gas Contamination

Soil gas data are provided under the *Soil Gas* divider.

Ten soil vapor samples were collected at nine locations as part of the October 2002 investigation (OCVOCEF 000593-OCVOCEF 000695). Maximum PCE, TCE, 1,1-DCE, 1,1,1,2-PCA, and 1,1,1-TCA concentrations detected were 130, 38, 80, 56, and 86 µg/L, respectively near the former degreasing tank, former waste storage areas, and southern property line. Other VOCs detected in soil vapor samples include cis1,2-DCE and 1,1-DCA (OCVOCEF 000616-OCVOCEF 000617).

An additional 24 soil vapor samples were collected at 12 locations in a subsequent investigation in 2003. Samples were collected at the southwestern corner of the site, waste storage areas, and near the former degreaser pit. Maximum PCE, TCE, 1,1-DCE, 1,1,1-TCA, and 1,1,1,2-PCA concentrations detected were 69, 48, 70, 80, and <5 µg/L, respectively. Other VOCs detected in soil vapor samples include cis1,2-DCE and 1,1-DCA (OCVOCEF 000278).

The VOCs were present above the detection limits in all samples in the vicinity of the degreaser pit, with the exception of the 40-foot samples. These results are in contrast with the soil results, where the VOCs were not detected. The difference in results is caused by the high detection limit used for the soil samples (500 µg/kg), and the greater volume of material sampled by soil gas. A nearby sample collected at Vista Paint at a depth of 40 feet (discussed further below) contained concentrations similar to those in the 20-foot samples collected near the degreaser pit.

The pie diagram figure for soil vapor (*Soil Gas* divider) shows the presence of PCE, TCE, 1,1-DCE, and 1,1,1-TCA near the degreaser, waste storage areas, and pickle liquor tanks. Given that the facility used PCE, TCE, and 1,1,1-TCA in the degreaser, this is expected. The 1,1-DCE was produced by degradation of 1,1,1-TCA that was used in the degreaser from about 1980 to closure in 1984 (i.e., soil gas survey performed 18-22 years after 1,1,1-TCA use). Together, 1,1,1-TCA

and 1,1-DCE make up approximately 75% of the VOCs, probably because of the later use of 1,1,1-TCA.

These VOC compounds are also present beneath the southern part of the building and along the southern property line. PCE is present in higher proportions than in the soil gas samples from the dip tank area. Approximately 280 cubic yards of soil (see Section 5.0) along the southern property line had previously been excavated in 1985, 7 to 8 years before the soil gas data were collected. The soil gas data indicate that VOC contaminants remained in the soil even after excavation of the soils.

A soil gas survey was conducted at Vista Paint, located west of the site, from February 23-25, 2009 (EST, 2009). Thirty-two soil vapor samples were collected from 12 locations around the perimeter of the Vista Paint building. Results are similar to soil gas concentrations measured at the site approximately 6 years earlier. Maximum PCE, TCE, 1,1-DCE, and 1,1,1-TCA concentrations detected were 69, 7.6, 51, and 30 $\mu\text{g/L}$ at VP-4 at a depth of 40 ft bgs. Most of the VOC concentrations at Vista Paint are lower than observed at the site. VP-4 (the closest VP location to the dip tank) had concentrations similar to those measured at the Crucible site, which suggests these contaminants migrated from the site. The pie diagram depicts similar proportions of 1,1-DCE, PCE, and 1,1,1-TCA in most locations at Vista Paint which mimic the observed proportions at the site.

In summary, the soil gas data indicate that Crucible released TCE, PCE, and 1,1,1-TCA near the degreaser pit, and in the area south of the building. The excavation of contaminated soils south of the building did not remove all the contaminated soils. La Barron Investments did not determine the vertical or lateral extent of the soil contamination.

4.2.3 Evidence of Groundwater Contamination

Neither Crucible nor LaBarron Investments have installed groundwater wells beneath the site or performed any type of groundwater investigation. The OCWD collected groundwater samples from one location east of the Crucible site, and three locations at or west of it. The upper zone of the shallow aquifer contained saturated conditions in all four borings. Carbon Creek is only partially lined in this area, and is a source of recharge water to the upper zone. Sample CM-GW01 was collected near the eastern property line. This sample was dominated by 1,1-DCE, and also contained PCE, TCE, and 1,1,1-TCA, in order of decreasing concentration. In the two upper zone samples collected near the west side of the Crucible building, PCE was the dominant COC. TCA-related compounds (1,1-DCE and 1,1,1-TCA) combined have a higher concentration than TCE. An upper zone sample was also collected from the west side of the building at 1850 East Orangethorpe, the property immediately west of Vista Paint. In this sample, 1,1-DCE has the highest concentration, with TCE and PCE having concentrations approximately equal to each other.

1,4-dioxane was present in all four upper zone samples. In the three eastern samples, the concentrations of 1,4-dioxane were approximately equal (20.2 to 27.2 $\mu\text{g/L}$). However, in the westernmost sample (CM-GW04), concentration of 691 and 685 $\mu\text{g/L}$ was measured in two duplicate samples. The average of two samples was 688 $\mu\text{g/L}$. These values are the highest concentrations measured in groundwater in the project area. The 1,4-dioxane concentrations

were higher than the sum of the concentrations of the other COCs (121.3 µg/L on average), indicating that most of the 1,4-dioxane was not released as a stabilizer in 1,1,1-TCA, but from another source.

OCWD also collected groundwater samples from the middle zone of the shallow aquifer at the same locations. In addition, data from the middle zone are also available from MW-23 (located approximately one thousand feet west southwest of the Crucible site), and from MW-22 (located approximately 700 feet southeast of the Crucible building). MW-22 and MW-23 are monitored by AC Products, a source of PCE contamination but no other COCs. Groundwater from these two easternmost sampling locations (CM-GW01 and MW-22) is dominated by PCE. The samples from west (downgradient) of the Crucible building (CM-GW02A, CM-GW03A, and CM-GW04A) contained PCE, but are dominated by 1,1-DCE, and also contain TCE.

The relative concentrations in MW-23 have changed through time (Overview Report, Plate entitled “Temporal changes in the distribution of groundwater contamination, middle zone of the shallow aquifer”). When the well was first sampled in 1998, the dominant COC was PCE, but 1,1-DCE, 1,1,1-TCA, and TCE were also present. As PCE concentrations downgradient of the AC Products facility have decreased because of remediation performed there, the proportions of PCE in MW-23 have declined. In the most recent period (2008-2011) depicted in the Overview Report plate, the majority of water samples collected downgradient (west) of the Crucible site (for example, at former Laura Scudder’s site and the former Northrop EMD site) and beyond have compositions that closely resemble the compositions of the samples collected at Crucible. Because both Crucible and at EMD used the same solvents, the proportions of COCs from each site are similar.

Information on the activities conducted at the Crucible site, and measured concentrations of these compounds in soil, soil gas, and groundwater indicate that Crucible contaminated the groundwater with 1,1,1-TCA and 1,1-DCE. It is also likely that the releases by Crucible of PCE and TCE also contaminated the groundwater with PCE and TCE. Because 1,4-dioxane was used as a stabilizer in 1,1,1-TCA, the release of 1,1,1-TCA by Crucible likely contaminated the groundwater with 1,4-dioxane.

5.0 REMEDIATION ACTIVITIES

Two “small areas” of soil contaminated by waste oil on the south side of the building were excavated to a depth of 3 ft during site closure in May 1984. These areas were filled in with clean crushed stone (CRU 00496). Based on the Site Assessment Plan the excavated areas appear to be located near borings A-1, A-2, and A-3 (CRU 00498). Also, based on the manifests, the excavated soils had a total volume of 55 cu. yd. (CRU 00440)

COC-contaminated soils were excavated from the area south of the building where high concentrations of 1,1,1-TCA and other COCs were found. Four truckloads (57 cu. yd.) of soil were excavated and transported to a Class I landfill on February 11, 1985. This soil volume was located within a semicircle from borings D-1, C-3, D-3, and D-2 to a depth of 5 ft. Also, “lightly contaminated” soil (TCA concentration < 2,000 µg/kg or <5,000 µg/kg) was removed from “Area B” (no figures available) and placed east of the building for aeration (CRU 00527; CRU 00544). Based on a description from a letter regarding the Site Remediation Plan (CRU 00514)

that a 30 x 100 ft area was to be remediated south of the building, it is assumed that "Area B" is the rectangular area south of the building minus the semicircle that was excavated. This soil (approximately 450-500 cu. yd.) was spread out no more than 4 in thick and allowed to aerate for about one week. After aeration this soil was placed on top of clean fill in the 30 ft x 100 ft area from the building to D-1 to D-3 at a thickness of two feet. No records of confirmatory soil samples from this area are available.

DTSC requested additional excavation between the Crucible fence line and the flood control channel south of Boring D-2 in a letter dated February 20, 1985 (CRU 00544). This area was used by Vista Paint as a chemical drum storage area (CRU 00546). An additional 16 truckloads of soil (224 cu. yd.) were excavated and sent to a Class I landfill on February 26, 1985. Area and depth of this excavation are unknown due to missing figures. On February 28, 1985, 16 truckloads of clean fill were brought to the site and placed in the excavation (CRU 00443-CRU 00444). No records of soil samples before or after excavation in this area are available.

Based on aerial photography review, all site features outside the main building (i.e., maintenance building, ammonia tanks, etc.) were either demolished or removed from the site between May 1984 and December 1986.

The release of solvents near the degreaser pit was not addressed by the remediation performed, and the remediation performed south of the building was incomplete. The excavation of the highly contaminated soils south of the building occurred approximately 8 years after use of PCE ended. These soils contained PCE, TCE, 1,1,1-TCA, and 1,1-DCE, as indicated by soil vapor samples collected approximately eight years after the soils were excavated. Thus, migration of solvents from this area would have occurred for more than 8 years, prior to the excavation, and is likely continuing today.

6.0 OPINION

Crucible used PCE, TCE, and 1,1,1-TCA to degrease tubing that was manufactured for use by the aerospace industry from 1959 to 1984. A 54-foot long degreaser pit containing a dip tank was located in the approximate center of the building. Virgin and waste solvents were stored at the south end of the facility. The limited characterization that was performed by Crucible and La Barron Investments indicate that solvents were released in these areas, but the data are insufficient to determine the extent of soil contamination. Crucible was ordered by the California Department of Toxic Substances Control (DTSC) to excavate solvent-contaminated soils at the south end of the property and on the parcel of land used by Vista Paint. Approximately 280 cubic yards were excavated in 1985, but soil gas data collected in 2003 indicate that solvents still remained in the soils.

Neither Crucible or La Barron Investments have characterized the groundwater beneath the site, but samples collected by OCWD and by others indicate that COCs released at the site have contaminated and are contaminating groundwater in a plume that extends probably to the Laura Scudder's site, and perhaps beneath EMD. The Crucible plume is commingled with PCE from AC Products, and TCE, PCE, and 1,1-DCE beneath and past the EMD site.

The limited soil remediation performed south of the building at the site has not removed contaminants from depths greater than a few feet. No remediation has been performed near the dip tank.

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